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BULLETIN

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IMPERIAL BUREAU OF MYCOLOGY

## WHITE PINES AND THE BLISTER RUST

General Bulletin No. 457

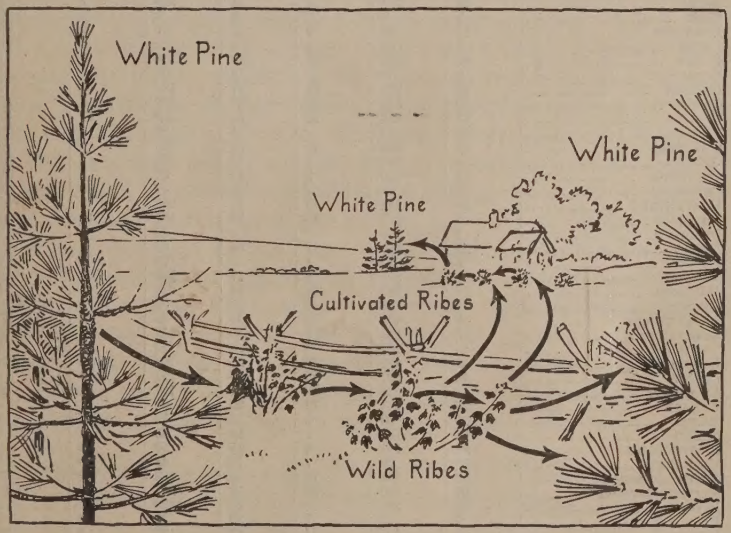


Diagram Showing Natural Spread of Blister Rust from White Pine to Ribes (Currant and Gooseberries) and from Ribes to White Pine.

C. G. JORDAN, *Secretary of Agriculture*
R. H. BELL, *Director, Bureau of Plant Industry*

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## TABLE I

### Results of School Survey for White Pine Blister Rust in Pennsylvania Showing the Data Obtained by the Schools in each County

| | County | Schools Reporting | Gardens Examined | Schools Reporting Black Currants | Gardens with Black Currants | No. Specimens Sent | Schools Reporting Blister rust | Specimens with rust |
|---|---|---|---|---|---|---|---|---|
| 1 | Adams | 20 | 151 | 8 | 23 | 64 | 5 | 8 |
| 2 | Armstrong | 14 | 62 | 3 | 3 | 60 | 0 | 0 |
| 3 | Bedford | 67 | 456 | 25 | 66 | 300 | 2 | 2 |
| 4 | Berks | 29 | 177 | 8 | 24 | 129 | 1 | 3 |
| 5 | Blair | 1 | 8 | 0 | 0 | 2 | 0 | 0 |
| 6 | Bradford | 17 | 97 | 9 | 22 | 51 | 7 | 10 |
| 7 | Bucks | 2 | 18 | 1 | 2 | 12 | 0 | 0 |
| 8 | Butler | 86 | 672 | 39 | 130 | 354 | 1 | 1 |
| 9 | Cameron | 9 | 66 | 4 | 8 | 28 | 0 | 0 |
| 10 | Carbon | 33 | 223 | 11 | 27 | 134 | 3 | 7 |
| 11 | Centre | 29 | 323 | 14 | 57 | 172 | 1 | 3 |
| 12 | Chester | 71 | 523 | 22 | 55 | 233 | 17 | 38 |
| 13 | Clarion | 10 | 72 | 4 | 13 | 32 | 0 | 0 |
| 14 | Clearfield | 43 | 328 | 25 | 91 | 222 | 1 | 2 |
| 15 | Clinton | 18 | 140 | 6 | 11 | 83 | 1 | 1 |
| 16 | Columbia | 12 | 100 | 5 | 11 | 31 | 2 | 2 |
| 17 | Crawford | 12 | 84 | 8 | 25 | 47 | 0 | 0 |
| 18 | Cumberland | 56 | 434 | 19 | 41 | 202 | 7 | 10 |
| 19 | Dauphin | 45 | 276 | 15 | 32 | 137 | 12 | 14 |
| 20 | Delaware | 3 | 12 | 2 | 3 | 12 | 0 | 0 |
| 21 | Erie | 25 | 180 | 11 | 34 | 67 | 0 | 0 |
| 22 | Forest | 5 | 20 | 1 | 3 | 29 | 0 | 0 |
| 23 | Franklin | 28 | 215 | 6 | 17 | 109 | 0 | 0 |
| 24 | Jefferson | 48 | 383 | 24 | 64 | 219 | 2 | 4 |
| 25 | Juniata | 15 | 68 | 6 | 26 | 53 | 2 | 2 |
| 26 | Lackawanna | 16 | 158 | 10 | 57 | 85 | 4 | 16 |
| 27 | Lancaster | 56 | 361 | 8 | 18 | 217 | 12 | 15 |
| 28 | Lawrence | 20 | 157 | 7 | 28 | 83 | 0 | 0 |
| 29 | Lebanon | 45 | 431 | 17 | 35 | 195 | 15 | 24 |
| 30 | Lehigh | 40 | 307 | 12 | 33 | 191 | 4 | 4 |
| 31 | Lycoming | 63 | 386 | 29 | 81 | 197 | 11 | 23 |
| 32 | McKean | 22 | 141 | 12 | 20 | 87 | 1 | 4 |
| 33 | Mercer | 16 | 83 | 6 | 11 | 38 | 0 | 0 |
| 34 | Mifflin | 15 | 135 | 7 | 18 | 83 | 4 | 5 |
| 35 | Montgomery | 24 | 174 | 8 | 15 | 93 | 0 | 0 |
| 36 | Montour | 16 | 79 | 7 | 12 | 48 | 0 | 0 |
| 37 | Northampton | 38 | 334 | 15 | 42 | 208 | 9 | 11 |
| 38 | Northumberland | 60 | 405 | 22 | 56 | 241 | 9 | 13 |
| 39 | Perry | 39 | 279 | 20 | 33 | 156 | 4 | 5 |
| 40 | Pike | 7 | 95 | 7 | 33 | 29 | 3 | 3 |
| 41 | Potter | 25 | 125 | 11 | 17 | 77 | 5 | 18 |
| 42 | Schuylkill | 116 | 1,016 | 56 | 205 | 641 | 25 | 57 |
| 43 | Snyder | 55 | 427 | 17 | 33 | 220 | 7 | 8 |
| 44 | Somerset | 32 | 412 | 11 | 42 | 175 | 1 | 3 |
| 45 | Sullivan | 12 | 132 | 11 | 43 | 70 | 10 | 34 |
| 46 | Susquehanna | 9 | 87 | 4 | 6 | 59 | 2 | 3 |
| 47 | Tioga | 75 | 633 | 28 | 92 | 301 | 15 | 23 |
| 48 | Union | 18 | 308 | 9 | 98 | 79 | 7 | 10 |
| 49 | Venango | 27 | 174 | 14 | 54 | 92 | 0 | 0 |
| 50 | Warren | 24 | 124 | 13 | 33 | 98 | 2 | 2 |
| 51 | Wayne | 54 | 386 | 28 | 101 | 212 | 30 | 72 |
| 52 | Wyoming | 21 | 168 | 8 | 34 | 77 | 0 | 0 |
| 53 | York | 73 | 456 | 20 | 51 | 289 | 9 | 10 |
| | TOTALS: | 1,716 | 13,061 | 693 | 2,089 | 7,123 | 253 | 465 |

# WHITE PINES AND THE BLISTER RUST

By W. A. McCubbin
Bureau of Plant Industry

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Until the past season this disease of white pine has been of little concern in Pennsylvania, the few known cases found in former years being confined to four or five of the northeastern counties close to the areas in New York and New England where this disease has been widespread and destructive for a dozen years or more. But in 1927 our apparent isolation has come to an abrupt end. A survey made through the public schools of the Commonwealth by the Pennsylvania Department of Agriculture in cooperation with the Federal Office of Blister Rust Control, disclosed the presence of blister rust on the alternate host (currants and gooseberries) in 37 counties. It was found by the school children in 465 gardens over an area as far south as the Maryland line and as far west as Butler County. Additional scouting by the State and Federal authorities informs us of the presence of rust in 5 other counties so we know rust existed last year in at least 42 counties in the state. It is probable that the reported cases on currants and gooseberries represent but a fraction of the actual infection present; in other words the rust probably occurred in many thousands of gardens, to say nothing of the wild gooseberries on which scarcely any examination was made.

In the accompanying maps (Figs. 1, 2 and 3) is shown the distribution in the Commonwealth of the blister rust found in 1927 by the school survey and other means. In these maps the county is taken as a unit and the stars do not indicate the exact location of the rust found there. Each star indicates that a pupil's speciman was found to bear blister rust. In table 1 there are recorded the general results of the school survey; this table, together with the maps, shows the extent of this survey, which in spite of scanty reports from certain counties is an accomplishment extremely creditable to the school children of the state.

**How much rust is known to be on our pine trees at the present time?** Yearly surveys have been made in previous years in areas most likely to be affected by this disease. The only rust found

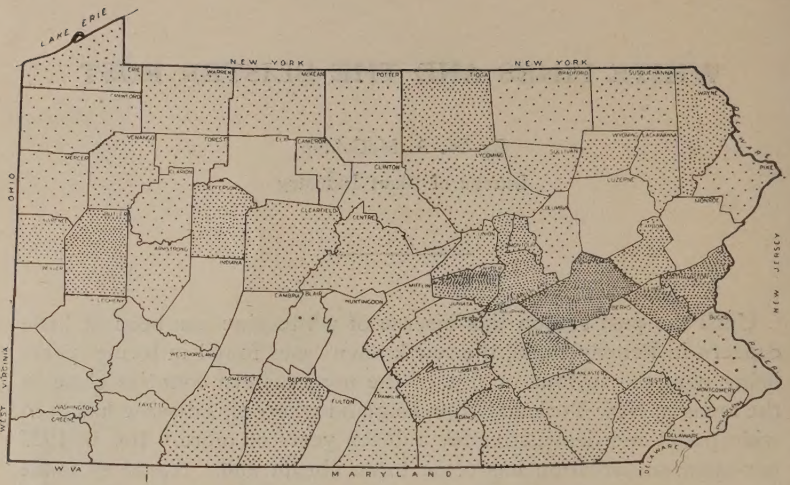


**Fig. 1—Map showing scope of blister rust school survey on garden currants and gooseberries. Each dot represents a speciman sent in as suspicious.**

established on pines up to and including 1927 includes three small areas in Wayne County and a similar small spot in Clarion County. It is quite likely however that the disease is already present in a few cases elsewhere which have not yet come to notice. The disease has not yet become widely spread on our white pines and the damage from it to date is negligible.

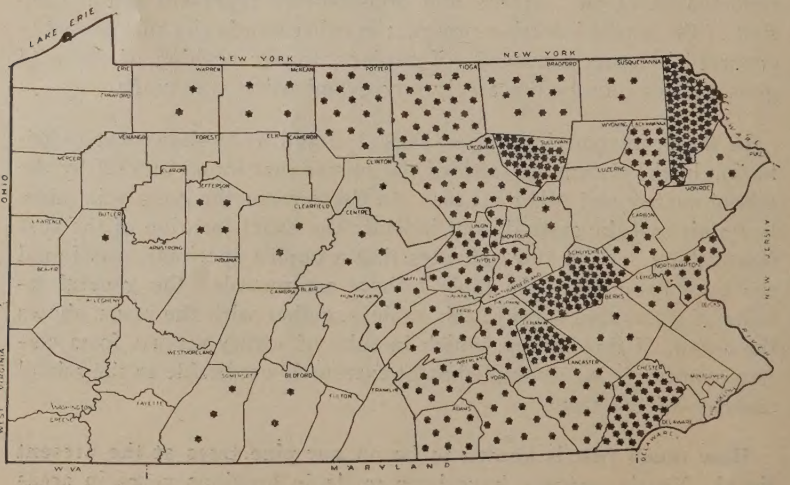


**Fig. 2—Every star indicates that the currant or gooseberry leaves sent in by a school pupil from that county were found to have blister rust.**

**Does this sudden epidemic of blister rust mean that our white pines are about to turn sickly and die all over this area?** Not at all. The disease is known to spread from the rusted currants and gooseberries to pine trees; in fact that is the only way pines can contract rust, for the disease does not spread from pine to pine. But it is only when white pines are fairly close to the infected currants that such infection is likely to take place. Ordinarily the rust finds difficulty in crossing a distance of more than 300 yards to pine trees. Further, infection is not so likely to take place on old pines as on young ones a few feet tall. We must also bear in mind the likelihood that we may not have this rust epidemic next season. In fact it may be five or ten years before a similar situation develops. The rust dies

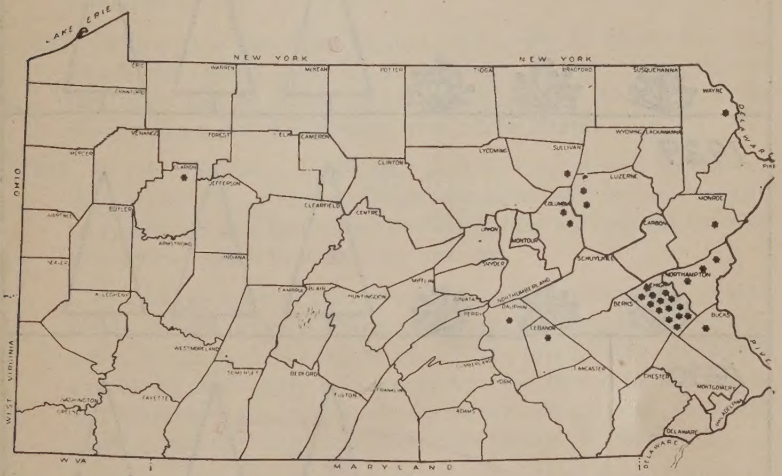


**Fig. 3—This map indicates the blister rust findings in 1927 independent of the school survey.**

out on currant and gooseberry leaves each fall and infection must start again in spring from spores carried in the wind from some infected pine. No spores—no rust. We have every reason to think that the epidemic of 1927 was caused by a great drift of these spores southward from the infected pines to the north of us; and that weather conditions here were unusually favorable for infection when they arrived and for multiplication throughout the summer. If such is the case we might go many years without meeting again this combination of circumstances favorable to rust.

While there are thus several factors which serve to lessen the probability of immediate damage to pine trees, it must be admitted that the state has to face from now on a blister rust problem. It

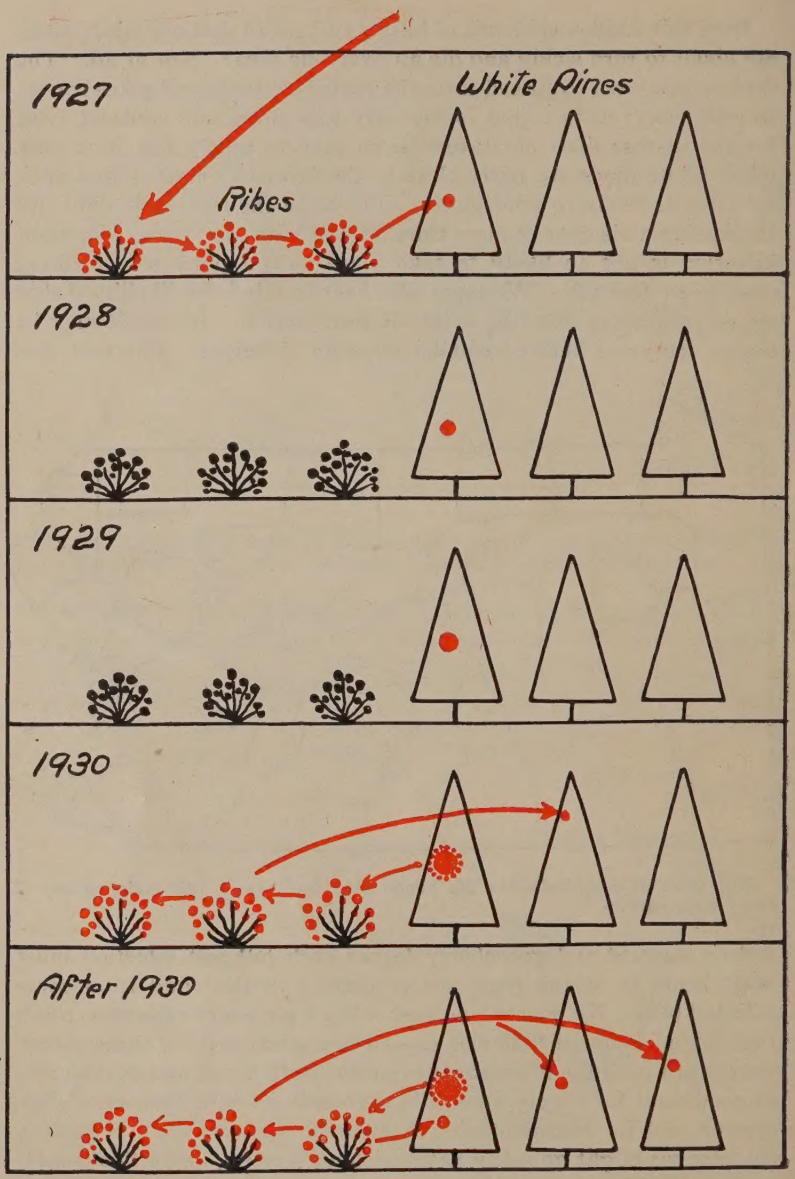


Fig. 4—Diagram showing the probable results that will follow the widespread occurrence of blister rust in 1927.

## PROBABLE DEVELOPMENT OF BLISTER RUST IN PENNSYLVANIA FOLLOWING THE WIDESPREAD INFECTION ON RIBES IN 1927 (See Fig. 4)

**1927** In 1927 rust spores from far away pines caused Ribes (currant or gooseberry) infection. Nearby white pines could readily become infected from these rusted currants and gooseberries.

**1928** Lacking further long distance spore drift Ribes (currant or gooseberry) plants will not be rusted, since the pine infection is not yet developed to the spore stage.

**1929** The Ribes may still be without rust. The bark infection on the pine is spreading and swelling the limb but no spores are produced as yet.

**1930** In this year the infected pine will probably produce spores which will readily infect adjacent Ribes. The rust spreads and multiplies on the Ribes and if conditions are favorable other nearby pines may be infected from these Ribes.

**1931** In this and every succeeding year the perennial infection on the pine will be a source of Ribes infection, and whenever weather conditions are favorable this Ribes rust will spread the disease to any pines that are near enough.

In another three or four years the second generations of pine infections started in 1930 and every year afterward, will begin to arrive at the spore bearing stage. When this happens the Ribes will be so thoroughly infected every year that they will reach and thereafter maintain their maximum capacity for infecting pines within the range of distribution (about 300 yards).

When pine infections are thus increased their multitude of spores will be spread far and wide in the wind, and may start Ribes infection many miles away. Our pines will then provide a local yearly source of Ribes infection quite independent of such accidental waves of infection as apparently came from the northeast in 1927. After 1930, and certainly after 1933, the blister rust will always be with us to the extent that weather conditions in various districts will permit it to develop.

The above forecast of probable blister rust development in Pennsylvania is based not only on its history elsewhere but on its behavior in the few places in our own state where it has existed for a few years. From this it is clear that protection of pines by eradication of Ribes will be most effective if undertaken before 1930 when we may expect the first Ribes reinfection. The golden years for eradication are 1928 and 1929.

is to be expected that here and there all over the state rusted currants and young pines were so close together that numerous pine infections could and did take place in 1927; and since the rust fungus is perennial in the pine bark it will stay there year after year whether our currants are rusted again or not. Further in two or three years these pine infections will begin to produce spores which will start infection in spring in local currants and gooseberries. When this begins to happen it will be of little importance whether we receive further spore drift from New England or not; the infected pines in our own state will keep up a widespread yearly infection on local currants and gooseberries, and this will naturally be followed by further pine infections wherever the two hosts are close enough to permit it (See Fig. 4). We may thus be assured that the disease is now well established in the state and as years go by it will go on increasing, at first slowly but afterwards by leaps and bounds as it gathers strength and multiplies.

**How can one determine the blister rust disease on white pines and distinguish it from other pine troubles?** Bulletin 452 of the Pennsylvania Department of Agriculture at Harrisburg gives descriptions of the disease on pines and lists other troubles that may be mistaken for it. This bulletin will be sent free on request.

**What trees are attacked by this blister rust?** It is a disease of 5-needled pines only and does not attack those with leaves in twos or threes, or any other tree. In our state the only native species subject to it is the common white pine *(Pinus Strobus)* though it may also occur on the occasional ornamental species with 5 needles that are sometimes planted. Among these is the low, bushy Swiss stone pine *(Pinus cembra)*.

Several related but distinct species of the blister rusts may be found on other native pines but these cause little damage, have secondary hosts other than currants and gooseberries, and do not occur on white pines.

**How will this disease affect currants?** On red and white currants and gooseberries the rust is rarely damaging. From the garden owner's point of view it normally does so little harm that it may be ignored. Moreover spraying methods, which would seem to be the only hopeful type of treatment for a leaf disease of this kind, have given very poor results in control of blister rust.

On the European black currant the disease is more important. It is so susceptible that every leaf may be covered with rust and the whole plant may be defoliated early in the season. On account of

its great susceptibility, its low value as a fruit, and particularly because it is a menace to pines in the vicinity, the European black currant should go out of cultivation as rapidly as possible in white pine areas.

The American black currant and the flowering currant, an ornamental shrubbery plant, are about on a par with red currants and gooseberies in their susceptibility to rust.

**Can we protect white pines from damage by blister rust?** The answer is fortunately: Yes. The whole matter of pine infection is summed up in three features: Young pines are more susceptible than older trees; infection does not pass from one pine to another but in all cases comes to pine from currant and gooseberry plants; and most important of all, pines are infected with difficulty from currants and gooseberries more than 300 yards distant. It is clear that if the two hosts are separated more than this distance the pines will be reasonably safe. This means in actual practice that all wild and cultivated currants and gooseberries *(Ribes spp.)* should be removed from in and around a pine area for the distance stated.

**Has such a method of protection been tried and is it successful?** In New York and New England Ribes eradication has been practiced for many years; in fact one-fourth of the pine areas of these states have already been protected by systematic removal of the alternate host plants. The evidence from the areas where eradication was first tried gives ample assurance that this eradication gives real protection from blister rust.

**Does the state intend to destroy all currants and gooseberries?** Certainly not. In the first place the pine areas in the state are limited, and the stands of pine that it would pay to protect are still fewer. Secondly, it is for the young pines, either natural growth or in plantations, that protection is most needed; old pines are not likely to suffer much damage before they mature. Thirdly, it is the accepted view that protection against this disease is now to be regarded in the same way as the control of potato blight, wheat smut and other long established diseases where the responsibility for protection rests with the owner. Consequently the present state policy will be directed towards aiding individual owners to protect their own pines by eradication methods.

**Where is Ribes eradication now necessary?** In view of the consequences likely to follow the blister rust epidemic of 1927 it is advisable to begin immediately the removal of Ribes from the neighborhood of all young pine plantations or from woodlots where second growth pines are present. It will be two or three years before pine infections started in 1927 become spore-producing and thus become capable of infecting nearby Ribes, from the rust on

which more pine infections may result. Eradication before 1930 is necessary to forestall this increase of pine infection, so that a great deal of eradication should be done in 1928 and 1929.

**When is the best time of the year to get rid of the wild currants and gooseberries in pine plantings or woodlots?** The great difficulty in Ribes eradication is to find the plants. Because they come into leaf very early in spring before most other plants start growth, they are easiest to find at this season. Further the ground is then wet and they are easily pulled out by the roots. However, they can and may be removed at any time of the year; in fact a pine owner should regard wild currants and gooseberries as outlaws to be destroyed at sight.

**How can one obtain information as to the best methods to follow in cleaning these plants out of a pine area?** The district forester will always be glad to give every assistance to anyone who wishes to protect his pines by Ribes eradication. He will be able to make this work much easier and simpler by showing where to look for Ribes, how to pull them cleanly, how to dispose of them, and how to check to see if any are being left.

**How long will eradication last?** How soon will these wild plants grow in again? In other words in how many years will eradication have to be repeated? Experiences in New England indicate that a good job of eradication will last at least five years, and under good conditions two or three eradications only will be necessary during the life of the pines. Over most of Pennsylvania eradication will be easy to keep on a permanent basis by a little effort devoted to removing stray bushes as these come under observation.

**What is the general prospect of damage to white pines in this state from blister rust?** In the cool, moist mountain sections wherever wild currants and gooseberries are plentiful this rust will kill off the young pines very rapidly. Three locations are known already where in small areas the destruction has been heavy. In the warmer sections, and elsewhere if the alternate hosts are scarce, the damage will be much less. In any case, however, the danger of loss is probably great enough to amply justify Ribes removal.

**With this situation facing us should one be cautious about planting white pines?** This tree, the best of all our forest species, can still be planted everywhere without the slightest fear, provided the alternate hosts are not allowed in the vicinity. It would be good judgment however, in setting out a white pine plantation, to choose if possible a location where wild Ribes are few; not that eradication would not be effective in any case, but simply because it would cost more to carry out eradication and keep it effective where these plants are too abundant.

# PENNSYLVANIA DEPARTMENT OF AGRICULTURE

## Organization and Services

C. G. JORDAN, *Secretary* R. G. BRESSLER, *Deputy Secretary*

This Department is essentially a service agency created by legislative enactment to deal with administrative, regulatory, investigational, and educational problems which can best be solved through public rather than individual action. The organization provides for coordination and cooperation with the Pennsylvania State College and the U. S. Department of Agriculture. The Department operates through the following bureaus:

### ANIMAL INDUSTRY: T. E. MUNCE, *Director and State Veterinarian*

Prevents and Eradicates transmissible diseases of animals and poultry, including tuberculosis of animals in cooperation with Federal Government.

Demonstrates to veterinarians control methods for transmissible animal diseases;

Supervises vaccination for and the prevention of hog cholera, anthrax, black leg and hemorrhagic septicemia;

Protects public from unwholesome meats through ante and post mortem examinations of animals at slaughtering establishments;

Inspects, licenses and furnishes information as to breeding, soundness and conformation of stallions and jacks standing for public service;

Enforces law requiring licensing of dogs and providing for protection of livestock and people from attacks of uncontrolled dogs;

Maintains laboratory for diagnostic research and experimental projects.

### PLANT INDUSTRY: R. H. BELL, *Director*

Tests agricultural seeds for purity and germination, and enforces State Seed Law;

Inspects orchards, parks, farms, and plant imports for injurious insects and plant diseases;

Inspects and licenses Pennsylvania nurseries, and licenses all dealers in nursery stock;

Makes investigations for the control of injurious insects and plant diseases including field tests of insecticides, fungicides and weed killers;

Enforces laws governing apicultural practices, disease control and housing;

Places and enforces quarantines and carries on eradication campaigns against insect pests and plant diseases;

Inspects and certifies potatoes for seed purposes;

Maintains collections of insects, plant diseases, plants, and seeds, and identifies specimens.

### FOODS AND CHEMISTRY: JAMES W. KELLOGG, *Director—Chief Chemist*

Accomplishes its purpose of protecting Pennsylvania homes against harmful foodstuffs by sampling analyzing, and bringing prosecution under the laws relating to foods and non-alcholic drinks, including milk, cream, butter, ice-cream, eggs, sausage, fresh meats, soft drinks, fruit syrups, vinegar and kindred food products;

Regulates and issues licenses for the manufacture and sale of oleomargarine;

Licenses and regulates egg-opening plants and cold storage warehouses, maintaining regular inspection and enforcing twelve-month storage limit;

Inspects milk plants and creameries and regulates weighing, testing, buying and selling of milk and cream on a butterfat basis;

Protects honest manufacturers, importers, selling agents and ultimate users of feeding stuffs, fertilizers, lime products, linseed oil, paint, putty, turpentine, insecticides and fungicides, by means of annual registrations followed by inspections, analyses, prosecutions and the publication of the analyses of these products;

Analyzes special samples for residents of the State at the rate of $1.00 a sample for feeding stuffs, lime products and linseed oils.

### MARKETS: GEO. A. STUART, *Acting Director*

Investigates and assists in the marketing of farm products; at present chiefly grain and hay, fruits and vegetables, poultry and eggs, and tobacco;

Compiles and distributes daily market information as to supplies, shipments and prices;

Advises growers on transportation of agricultural products;

Assists cooperative associations and public markets;

Establishes standard grades of farm products and maintains inspection.

### STATISTICS: L. H. WIBLE, *Director*

Assembles and disseminates essential statistics and facts pertaining to the agriculture of the State, from monthly reports rendered by hundreds of volunteer crop correspondents, information which assists the producer in his sales and interests all industries which deal with agricultural products;

Cooperates with U. S. Bureau of Agricultural Economics in joint crop and livestock reporting and publishes annual and monthly summaries of the data;

Compiles dates of county and local fairs and assembles data pertaining to their success and results during each year.